# An assessment of equatorial Atlantic interannual variability in OMIP simulations

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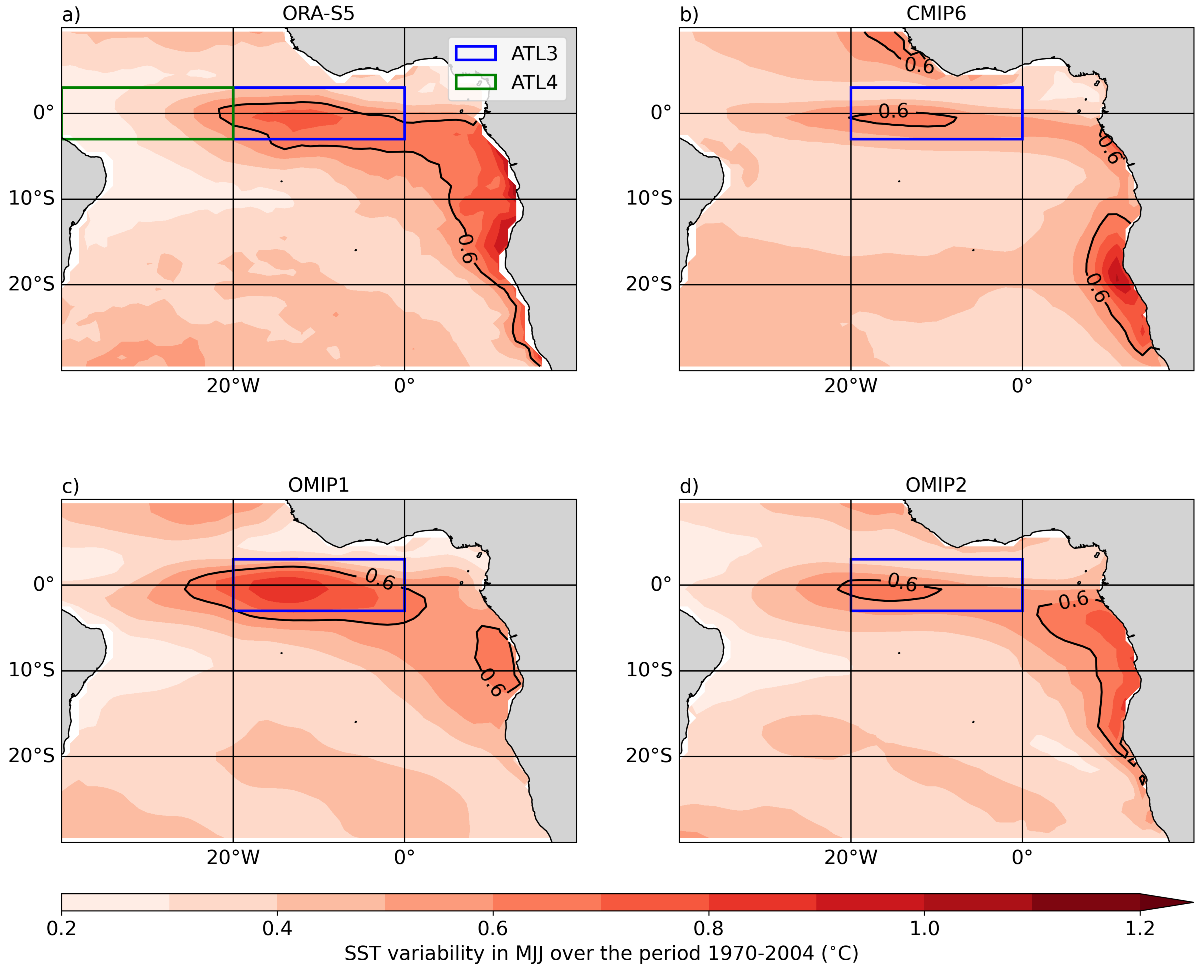


**Figure S1.** Interannual SST variability in the tropical Atlantic during MJJ. Standard deviation of the MJJ-averaged SST anomalies for (a) ORA-S5, (b) CMIP6 ensemble mean, (c) the OMIP1 ensemble mean, and (d) the OMIP2 ensemble mean spanning from January 1970 to December 2004. The blue and green boxes represent the ATL3 (20°W-0°E, 3°S-3°N) and ATL4 (40°W-20°W, 3°S-3°N) regions, respectively.

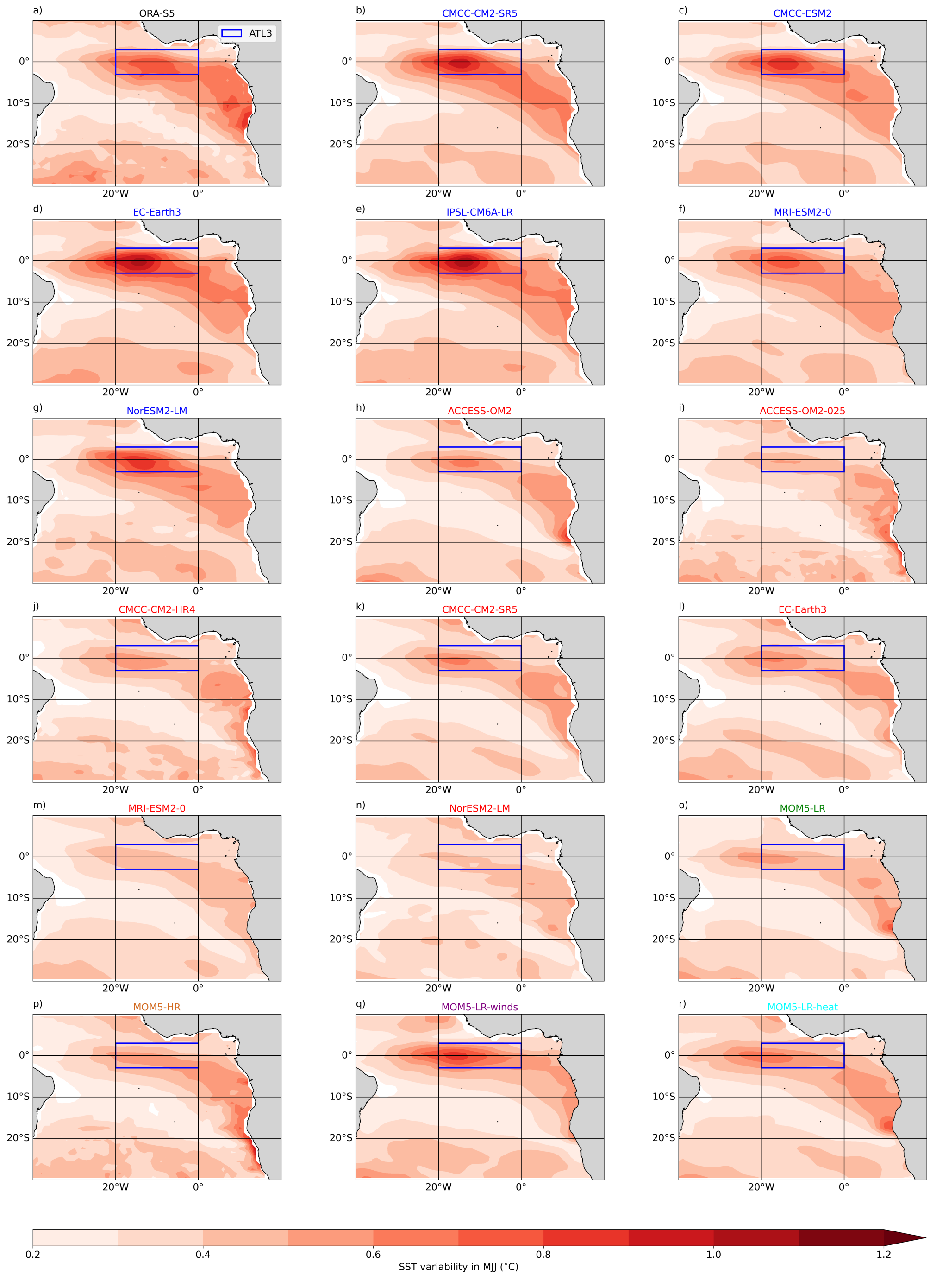


**Figure S2.** Tropical Atlantic interannual SST variability in MJJ. Standard deviation of the MJJ-averaged SST anomalies for (a) ORA-S5, (b-g) OMIP1 models, (h-n) OMIP2 models, and (o-r) the MOM5-LR, MOM5-HR, MOM5-LR-winds and MOM5-LR-heat experiments over the period from January 1985 to December 2004. The blue box depicts the ATL3 region (20°W-0°, 3°S-3°N).

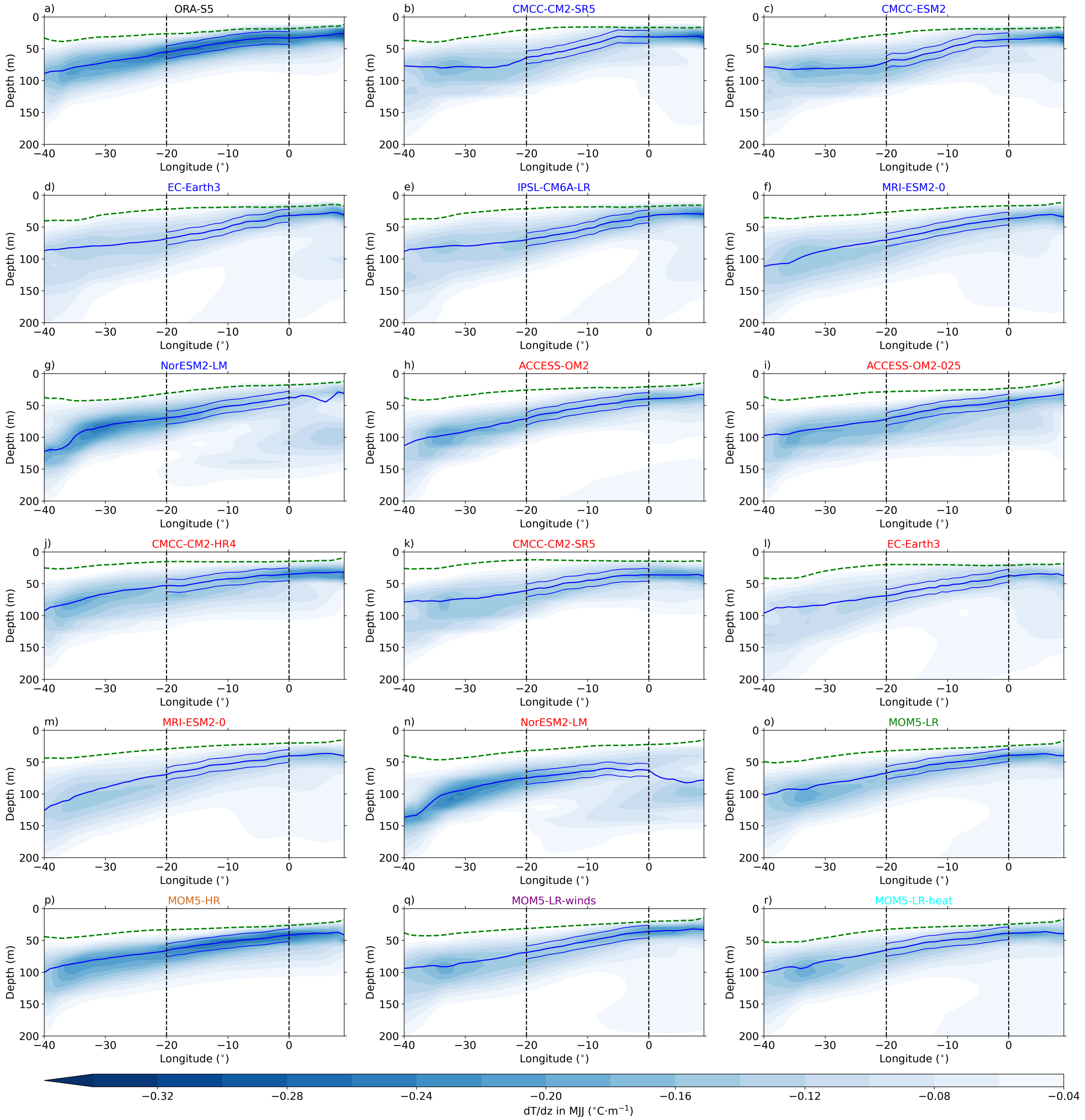


**Figure S3.** Upper 200 m equatorial Atlantic vertical temperature gradient in MJJ averaged between 3°S-3°N for (a) ORA-S5, (b-g) OMIP1 models, (h-n) the OMIP2 models, and (o-r) the MOM5-LR, MOM5-HR, MOM5-LR-winds and MOM5-LR-heat experiments over the period from January 1985 to December 2004. The dashed green line represents the MLD in MJJ. The solid blue line is the depth of the maximum dT/dz in MJJ and the thin blue line are located ± 10 m around the depth of the maximum dT/dz in MJJ. Vertical dashed black lines depict the ATL3 region.

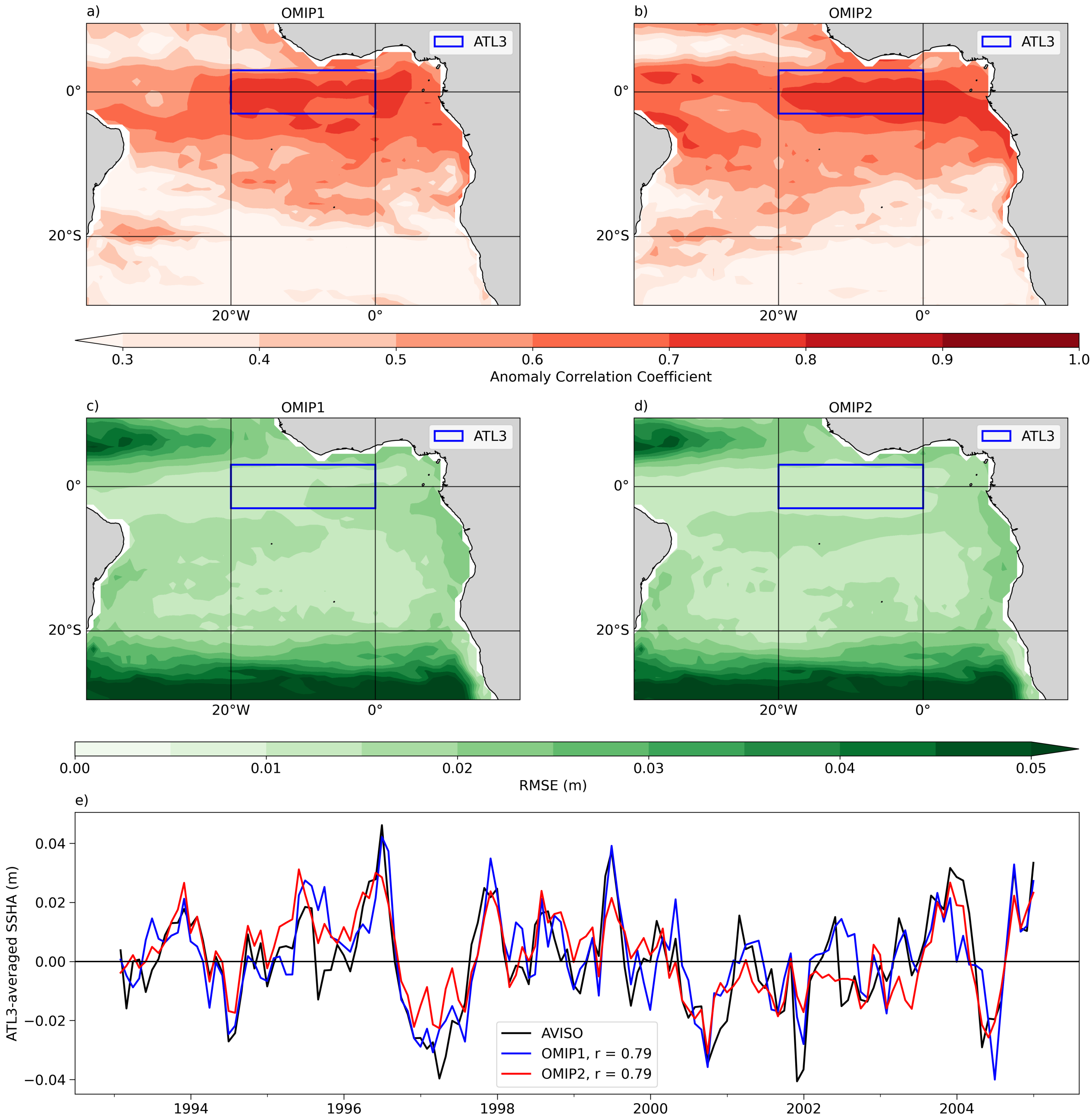


**Figure S4.** Anomaly correlation (a, b) and root-mean-square error (RMSE; c, d) of OMIP1 and OMIP2 simulations with AVISO over the period January 1993 to December 2004. (e) Timeseries depicting ATL3-averaged monthly SSH anomalies from January 1993 to December 2004 for the AVISO product (black), the OMIP1 ensemble mean (blue) and for the OMIP2 ensemble mean (red). The legend denotes Pearson correlations between the OMIP1 and OMIP2 ensemble means and the AVISO product.

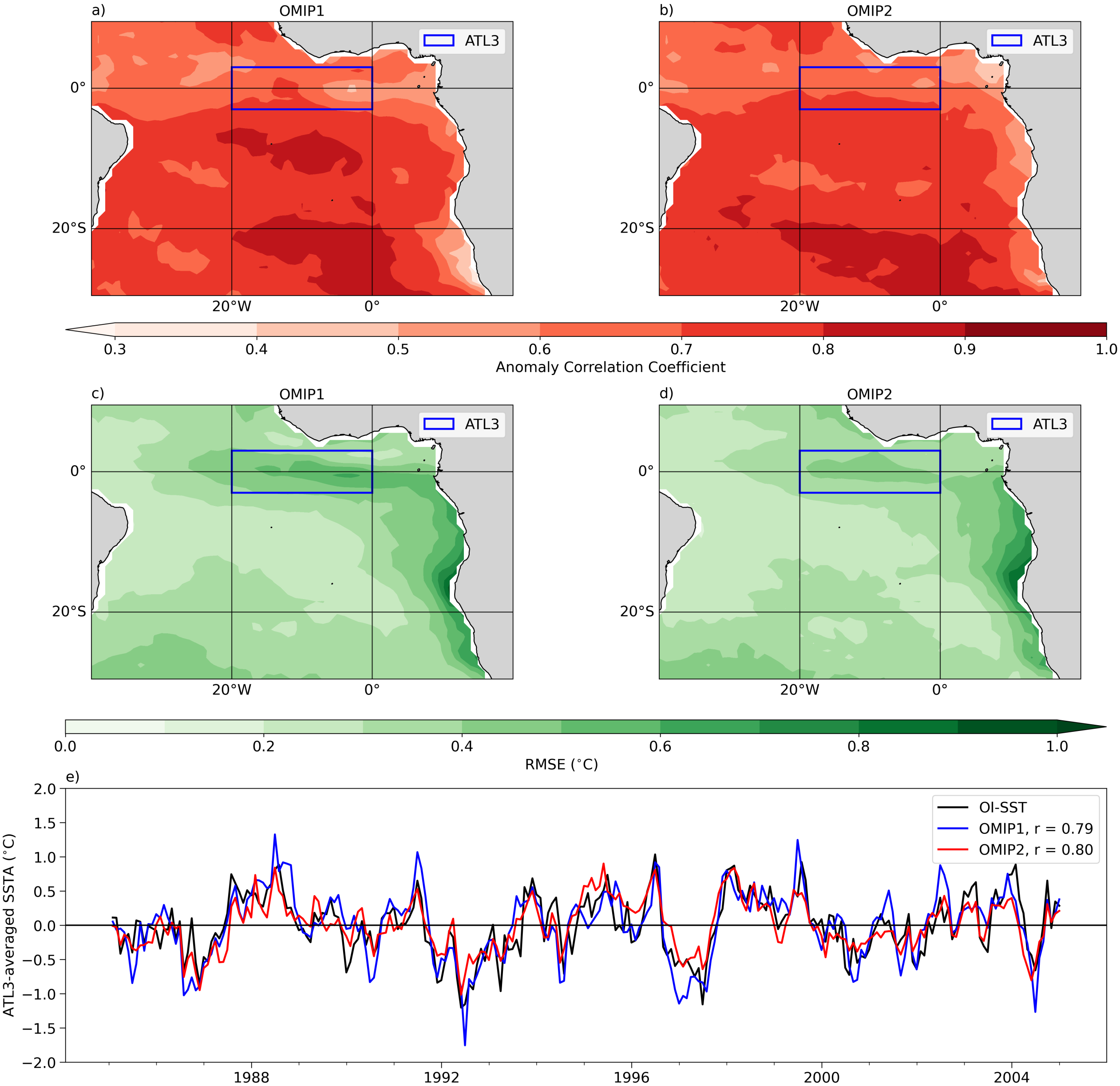


**Figure S5.** Anomaly correlation (a, b) and root-mean-square error (RMSE; c, d) of OMIP1 and OMIP2 simulations with OI-SST over the period January 1985 to December 2004. (e) Timeseries depicting ATL3-averaged monthly SST anomalies from January 1985 to December 2004 for the AVISO product (black), the OMIP1 ensemble mean (blue) and for the OMIP2 ensemble mean (red). The legend denotes Pearson correlations between the OMIP1 and OMIP2 ensemble means and the OI-SST product.

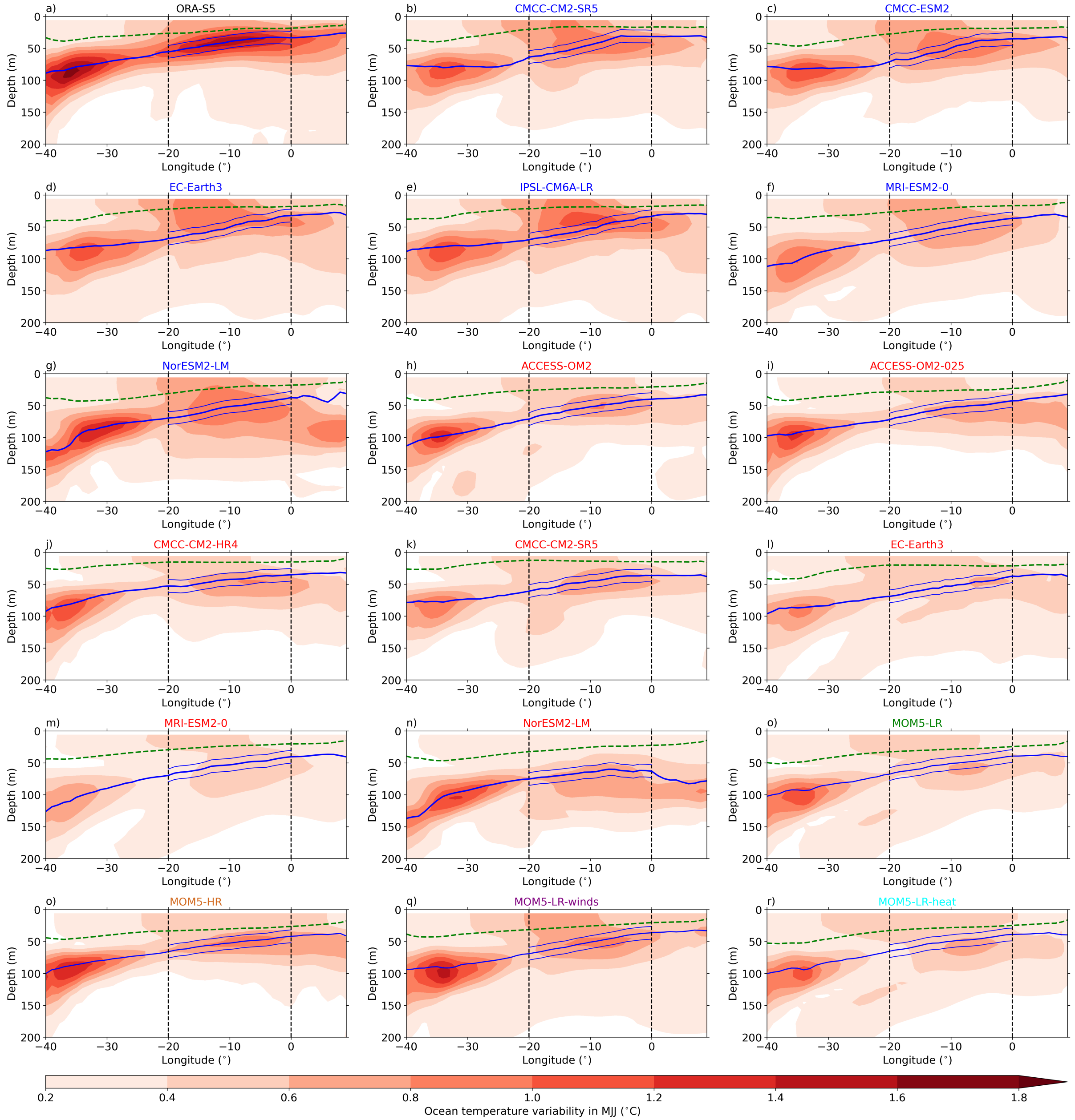


**Figure S6.** Upper 200 m equatorial Atlantic interannual temperature variability in MJJ. Standard deviation of the MJJ-averaged temperature anomalies averaged between 3°S-3°N for (a) ORA-S5, (b-g) OMIP1 models, (h-n) the OMIP2 models, and (o-r) the MOM5-LR, MOM5-HR, MOM5-LR-winds, and MOM5-LR-heat experiments over the period from January 1985 to December 2004. The dashed green line represents the MLD in MJJ. The solid blue line is the depth of the maximum dT/dz in MJJ and the thin blue line are located ± 10 m around the depth of the maximum dT/dz in MJJ. Vertical dashed black lines depict the ATL3 region.

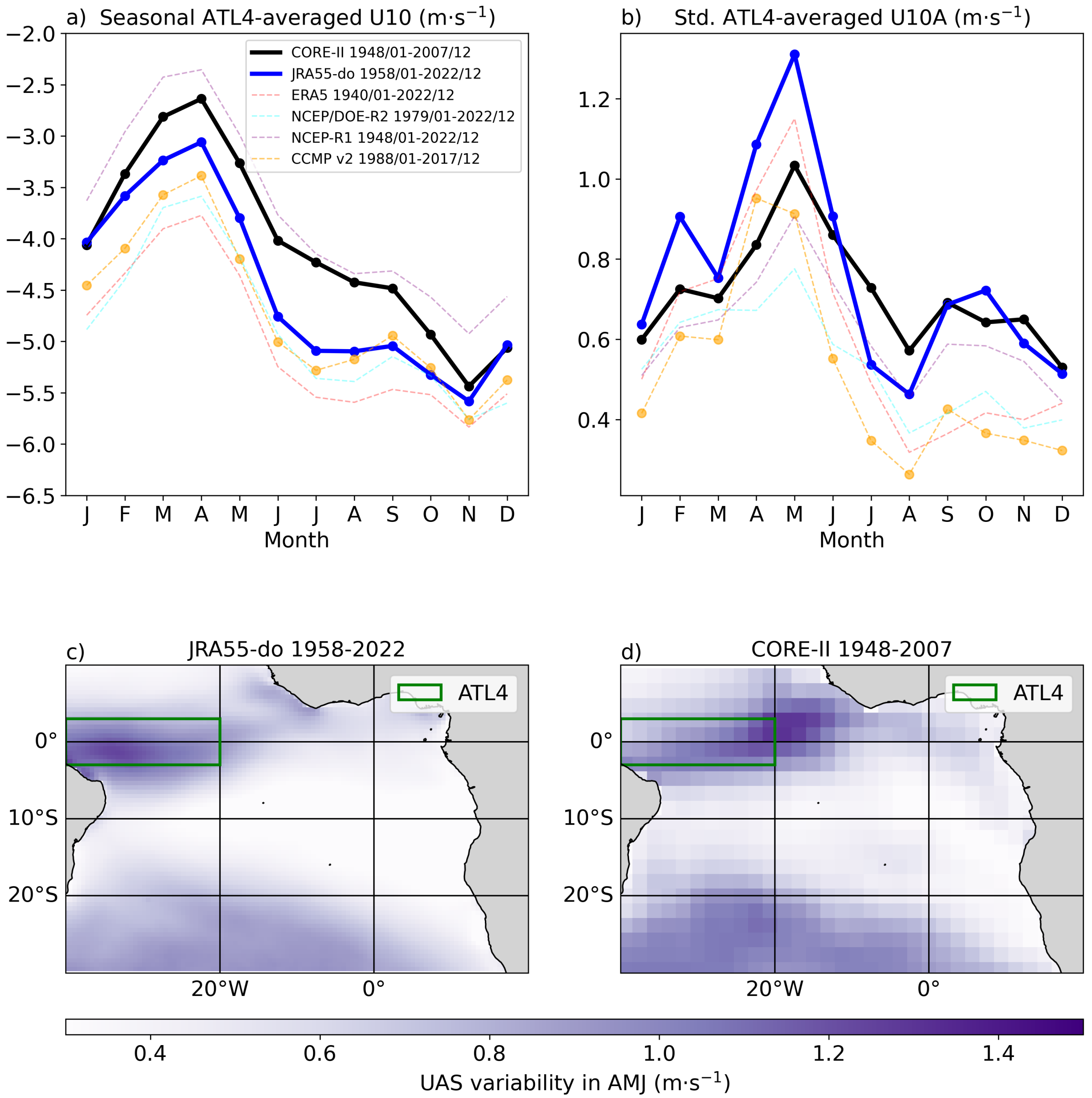


**Figure S7.** Western equatorial Atlantic U10 seasonal cycles. (a) Seasonal cycle of U10 winds averaged over the ATL4 region for different time periods. (b) Seasonal cycle of the standard deviation of U10 anomalies averaged over the ATL4 region for different periods. Different lines correspond to various reanalysis products: (black) CORE-II from January 1948 to December 2007, (blue) JRA55-do from January 1958 to December 2022, (red) ERA5 from January 1940 to December 2022, (cyan) NCEP/DOE-R2 from January 1979 to December 2022, (purple) NCEP-R1 from January 1948 to December 2022, and (orange) CCMP v2 from January 1988 to December 2017. (c, d) Standard deviation of U10 anomalies over the tropical Atlantic during AMJ for JRA55-do, and CORE-II respectively.

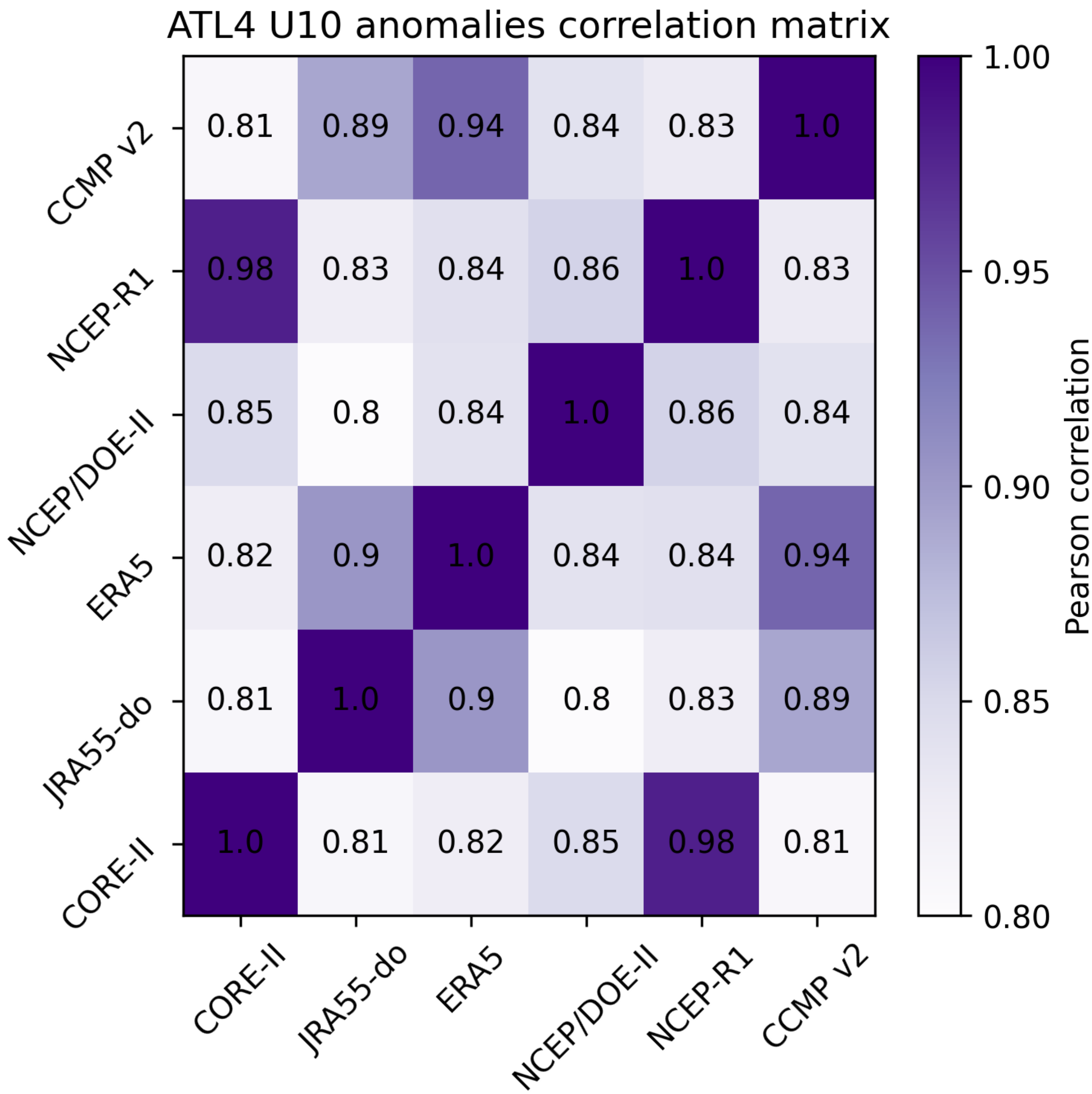


**Figure S8.** Correlation matrix for zonal wind anomalies at 10 m height in the western equatorial Atlantic. Correlation coefficients are based on Pearson correlation coefficients evaluated over the period January 1985 to December 2004. The datasets included in the matrix are: CCMP v2, NCEP-R1, NCEP/DOE-II, ERA5, JRA55-do, and CORE-II.

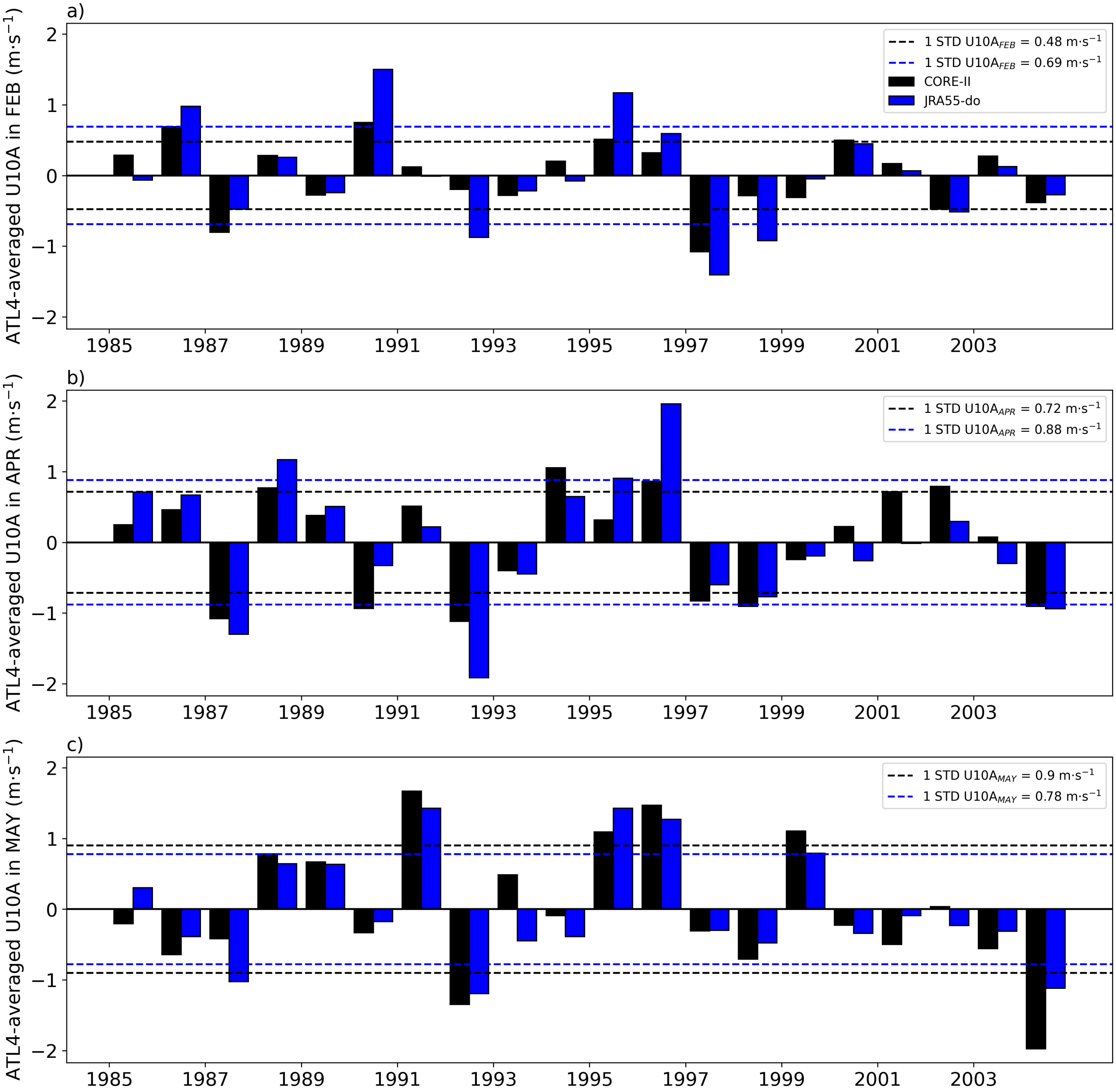


**Figure S9.** Western equatorial Atlantic zonal wind anomalies at 10 m height. (a) Timeseries of the ATL4-averaged U10 anomalies for February spanning the period from January 1985 to December 2004, using CORE-II (black) and JRA55-do (blue) reanalysis datasets. (b) Same as (a) but for April. (c) Same as (a) but for May. Black (Blue) dashed lines represent $\pm$ 1 standard deviation of the U10 anomalies.

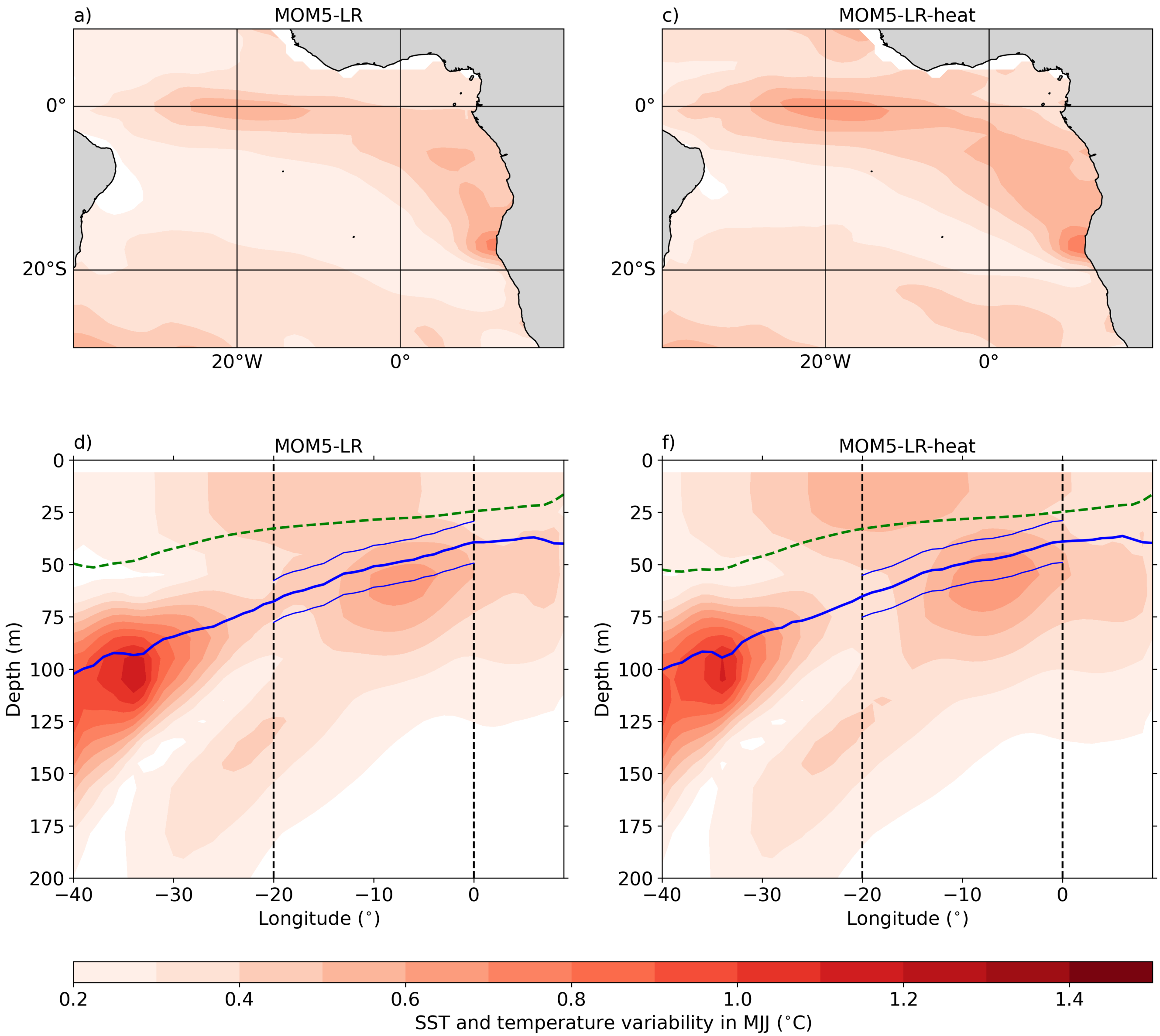


**Figure S10.** SST and temperature interannual variability in MJJ over the period from January 1985 to December 2004. Standard deviation of the MJJ-averaged SST anomalies for (a) MOM5-LR and (b) MOM5-LR-heat. Standard deviation of the upper 200 m depth equatorial Atlantic (3°S-3°N) MJJ-averaged temperature anomalies for (a) MOM5-LR and (b) MOM5-LR-heat. The dashed green lines represent the MLD. The solid blue lines are the depth of the maximum vertical temperature gradient in MJJ. Thin blue lines represent the ± 10 m around the mean thermocline. Vertical dashed black line exhibit the ATL3 region.

**Table S1.** CMIP6 models (0-17) used in this study.

| Num | Model name | Ocean model | Ocean grid (lon $\times$ lat $\times$ lev) | Atmospheric model | Atmospheric grid (lon $\times$ lat $\times$ lev) |
|---|---|---|---|---|---|
| 0 | ACCESS-CM2 | MOM5 | $360 \times 300 \times 50$ | UKMO UMv10.6 | $192 \times 144 \times 85$ |
| 1 | ACCESS-ESM1.5 | MOM5 | $360 \times 300 \times 50$ | UKMO UMv7.3 | $192 \times 145 \times 38$ |
| 2 | BCC-CSM2-MR | MOM4 | $360 \times 232 \times 40$ | BCC_AGCM3_MR | $320 \times 160 \times 46$ |
| 3 | CAMS-CSM1-0 | MOM4 | $360 \times 200 \times 50$ | ECHAM5_CAMS | $320 \times 160 \times 31$ |
| 4 | CAS-ESM2-0 | LICOM2.0 | $362 \times 196 \times 30$ | IAP AGCM 5.0 | $256 \times 128 \times 35$ |
| 5 | CMCC-CM2-SR5 | NEMO3.6 | $362 \times 292 \times 50$ | CAMS5.3 | $288 \times 192 \times 30$ |
| 6 | CMCC-ESM2 | NEMO3.6 | $362 \times 292 \times 50$ | CAMS5.3 | $288 \times 192 \times 30$ |
| 7 | CanESM5 | NEMO3.4.1 | $361 \times 290 \times 45$ | CanAM5 | $128 \times 68 \times 49$ |
| 8 | EC-Earth3-Veg | NEMO3.6 | $362 \times 292 \times 75$ | IFS cy36r4 | $512 \times 256 \times 91$ |
| 9 | EC-Earth3-Veg-LR | NEMO3.6 | $362 \times 292 \times 75$ | IFS cy36r4 | $320 \times 160 \times 62$ |
| 10 | INM-CM4-8 | INM-OM5 | $360 \times 318 \times 40$ | INM-AM4-8 | $180 \times 120 \times 21$ |
| 11 | INM-CM5-0 | INM-OM5 | $720 \times 720 \times 40$ | INM-AM5-0 | $180 \times 120 \times 73$ |
| 12 | IPSL-CM6A-LR | NEMO-OPA | $362 \times 332 \times 75$ | LMDZ | $144 \times 143 \times 79$ |
| 13 | KIOST-ESM | MOM5.0 | $360 \times 200 \times 52$ | GFDL-AM2.0 | $192 \times 96 \times 32$ |
| 14 | MIROC6 | COCO4.9 | $360 \times 256 \times 63$ | CCSR AGCM | $256 \times 128 \times 81$ |
| 15 | MPI-ESM1.2-HR | MPIOM1.63 | $802 \times 404 \times 40$ | ECHAM6.3 | $384 \times 192 \times 95$ |
| 16 | MPI-ESM1.2-LR | MPIOM1.63 | $256 \times 220 \times 40$ | ECHAM6.3 | $192 \times 96 \times 47$ |
| 17 | MRI-ESM2-0 | MRI.CMO4.4 | $360 \times 364 \times 61$ | MRI-AGCM3.5 | $320 \times 160 \times 80$ |